

STEP 5: SYNTHESIS AND INTERPRETATION

The comparison of current watershed condition with reference conditions assists decision makers in determining the need for management actions and treatments to help achieve management goals. The purpose of this section is to compare existing and reference conditions of specific ecosystem elements and to explain the causes of the similarities, differences, and trends where possible. The interaction of physical, biological, and social processes is acknowledged in the discussions and the capability of the watershed to achieve key management plan objectives is evaluated.

Each of the key issues identified is discussed within the context of the core topics. Any obvious differences between current conditions and the reference conditions are noted and recommendations to “close the gap” will be made in the following section. Additional topics that are not directly related to the issue identified are also addressed if they are deemed to be important for guiding future management direction for the watershed, or will result in a recommendation. Applicable core questions from the *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis* (USFS 1995) are used to guide the analysis. The questions addressed to the degree possible with the information presented in this document are as follows:

- What are the natural and human causes of change between historical and current resource conditions in the watershed?
- What are the influences and relationships between specific resource conditions and other ecosystem processes?

Overview

Core topics identified and not relevant to the District are erosion processes, water quality, vegetation, species and habitats, and human uses. Some of the measurable indicators of these topics were presented in Step 3. Current Conditions lend themselves to comparisons between watersheds and between topics within a watershed, especially when the indicators are converted to comparable units per acre to eliminate the differences in watershed size and concentrate on the actual conditions in each. **Table 20** summarizes these indicators. The rating for unsatisfactory condition was derived from the TES database soil map unit interpretations that identify areas as either “unsuited” or “gullied.” The annual sheet and rill erosion rates are derived from the soil loss in tons per year by watershed divided by the watershed acreage, as is the annual sediment yield from roads.

Table 20. Comparison of Key Watershed Conditions

| Watershed | Acres in District | Unsatisfactory Condition | Sheet/Rill Erosion (tons/acre/year) | Annual Sediment Yield from Roads (tons/acre) | Wildlife Habitat in Core Areas (%) | Road Density | Archaeological Sites/100 acres |
|-----------|-------------------|--------------------------|-------------------------------------|----------------------------------------------|------------------------------------|--------------|--------------------------------|
| Bancos | 59,109 | 63% | 1.5 | 0.02 | 12% | 1.6 | 12.5 |
| Carracas | 13,193 | 27% | 1.4 | 0.03 | 7% | 1.9 | 7.6 |
| Compañero | 32,837 | 35% | 1.3 | 0.03 | 2% | 2.6 | 7.3 |
| La Jara | 52,389 | 39% | 1.4 | 0.02 | 4% | 2.1 | 7.0 |

Seeing the data in this format facilitates an understanding of the conditions of each watershed and their effects on other resources. For example, Bancos has the highest proportion of area in unsatisfactory condition, the highest sheet and rill erosion rate per acre, and the highest concentration of archaeological sites. This would point to a justified management concern for the stability of the cultural resources in the Bancos watershed that may result in on-site investigations to develop protection measures.

Table 20 can also be used to check the reasonableness of the data presented. For example, it makes sense that the watershed with the greatest amount of habitat within core areas also contains the lowest road density.

Erosion Processes

The lack of quality vegetative cover and the acreage of surface disturbance, combined with a predominance of naturally erodible soils and relatively high peak flows generated by stormwater runoff combine to cause accelerated erosion throughout the District.

Current sheet and rill erosion can be attributed to the lack of ground cover due to sparse vegetation, especially native grasses and forbs that hold soil in place during rainfall and runoff events. Lack of ground cover and sparse vegetation has been attributed to bare ground from construction activities for gas development, which removes 2 to 3 acres of native vegetation for well pads, in addition to road construction and pipeline installation. The past few years of drought, combined with overgrazing by wild horses in addition to forage utilization by cattle and elk, have severely damaged the understory vegetation that provides protection from erosion and filters sedimentation from surface water runoff before reaching the stream system.

Obviously, the drought conditions are beyond the control of any management plan. However, the ecosystem can recover from some of the historic and current erosion problems with a management plan that targets the sources of the damage. As documented in the TES database, current erosion rates do not exceed tolerance levels for sheet and rill erosion, indicating that the system can recover over the long term with appropriate management decisions. There are requirements associated with the Conditions of Approval for each permit to drill a gas well that soil that has been disturbed must be reseeded with native grasses to replace the ground cover. However, monitoring is not conducted to ensure that the revegetation efforts are successful, so they often remain bare ground that is subject to erosion.

Gully erosion has permanently removed productive soil and altered the ecosystem in each watershed to varying degrees, but appropriate management choices can stabilize the gullies and limit future damage that would occur if they are allowed to continue to erode, ultimately damaging cultural resources, roads, trails, and water quality.

At this time, erosion processes are not under control to the degree necessary to meet the reference conditions and the goals of the Forest Plan, but significant improvements can be made that would result in improved soil productivity, vegetation condition, and downstream water quality necessary to achieve satisfactory watershed conditions.

Water Quality

Water quality in the San Juan River downstream from the watersheds in the District does not currently meet the uses designated by the state, mainly due to sedimentation from upstream land uses. Most of the identified parameters of concern (sediment, turbidity, and stream bottom deposits) are derived from erosion processes on the landscape that contribute pollutants that reach the system of arroyos and waterways and are carried to the San Juan River during runoff events. Natural and accelerated (human-caused) erosion contribute to this condition. While the Forest Service cannot control lands outside its authority, the goal stated in the Forest Plan that water flowing from National Forest lands will meet state water quality standards justifies implementing management objectives that minimize sediment yield leaving the District.

A major contributor to water quality impairment has been identified as the unpaved roads that supply significant quantities of sediment to the surface water system. The increasing density of unpaved roads within the District, due to the infilling of gas wells, has increased the sources of sedimentation to the stream system. In many cases, these roads have not been constructed according to recommended standards and guidelines for water control structure types and spacing, gradients of the roads for a specific slope length, and surfacing materials at and near stream crossings. If erosion processes were controlled, downstream sedimentation would be reduced and the Forest Service could achieve its goal of meeting state water quality standards.

Vegetation

Vegetative diversity exists within the District, but is undergoing change due to the degradation of native grasslands due to overgrazing and surface disturbing activities associated with gas development. As vegetation is removed by construction activities, some of the disturbed areas are left as bare ground, while portions are revegetated with grasses that do not serve the same purpose for wildlife compared to native vegetation.

The goal to keep vegetation removal and damage to a minimum has not been met, as evidenced by the acreage removed for wells and roads presented in Table 8. When considering this in conjunction with the poor vegetative condition of the understory vegetation and the lack of successful revegetation efforts due to drought conditions, these factors contribute to the change in vegetation in each watershed. Those watersheds within the Wild Horse Territory have the poorest vegetative condition, but those watersheds with higher densities of gas wells and roads have the largest acreage of surface disturbance and the highest potential for the spread of noxious weeds due to increased gas service vehicle traffic.

Development and implementation of weed management plans, as required by Forest Service regulations and policy, should be adequate to control the spread of weeds that compete with native vegetation. Enforcement of the measures in each plan is essential to change the current trend of increasing invasive plants within the District. Weed management will be increasingly more difficult to control as new roads and traffic to serve gas wells increase.

As identified under erosion processes, if the condition of vegetation, especially understory vegetation that minimizes soil erosion and sedimentation into streams, were improved, soil productivity, downstream water quality, and forage production would also be improved, resulting in improved overall watershed health. These enhancements of watershed condition are achievable with implementation of existing and possibly revised management plans.

Species and Habitats

Wildlife species and habitats are strongly affected by vegetation condition. Another key factor in managing wildlife habitat and the associated success of species populations is the amount of fragmentation and human disturbance that exists.

The Forest Plan requires that the density of open roads not exceed 0.5 mi/mi² within the deer and elk winter range areas within the District. Current average road densities exceed these limits, by 0.1 mi/mi² and 0.6 mi/mi² in the deer and elk winter ranges, respectively, although the density in the Carracas watershed deer winter range meets the standard. While there are no thresholds on overall road density within the Forest Plan or other policies and guidelines, research has shown that the road densities and resulting core areas (see Table 9 above) that currently exist in the District are likely to negatively affect some bird species, elk, and deer.

The only MIS within the District that shows a downward population trend is the plain (juniper) titmouse, resident of piñon-juniper canopy habitat. Bancos and Compañero watersheds contain the most juniper titmouse habitat. Causes for this are most likely related to removal of the necessary habitat for gas well development and associated road and pipeline construction.

If wild horse populations were managed according to the current management plan, reductions of up to 130 horses would be necessary. An environmental assessment for a new management plan is currently under development by District resource specialists and may propose new optimum numbers for the herd based on forage production and utilization. Due to the importance of grasses and forbs to the soil productivity and erosion control in the Wild Horse Territory, predominantly within the Carracas and Bancos watersheds, and the damage sustained to this vegetation by the aggressive grazing by these wild horses, it is clear that some reduction in herd size is essential to improve watershed condition.

Vegetation management is again a critical component in the sustainability of good watershed conditions relative to the maintenance of species and habitats. The other critical factor that must be managed to support the protection of wildlife species and habitats within the District is the density of roads that fragment

habitat, facilitating vehicle traffic that disrupts wildlife populations, and increases access for predators. Current management plans do not adequately address the problem of wildlife habitat fragmentation.

Human Uses

Minerals

The vision stated in the Forest Plan is to extract minerals while minimizing impacts to surface resources. Development of gas wells and the associated infrastructure has occurred with required site-specific NEPA compliance in the form of impact evaluation at the location of each well pad, but without the overall vision of the cumulative effects of mineral development in the District as a whole or in each watershed encompassing the District. As a result, the Forest Service has met the stated intent of the Forest Plan without full knowledge of the overall effects of infill drilling. Drilling has been projected to almost double over the next 20 years, so an understanding of potential effects of gas development is critical to manage the impacts on natural and cultural surface resources, as required by the Forest Plan and other federal guidance.

Mineral development has contributed significantly to the degradation of watershed conditions by the removal of vegetation resulting in bare ground that is exposed to soil erosion, contributing to increased sediment deposition in the stream system. While the total acreage of surface disturbance is not great, the distribution throughout the District and across a variety of soil types and slopes, spreads its impact across the watersheds, with the Compañero and La Jara watersheds the most affected. Revegetation of disturbed areas has been unsuccessful over the past few years, in part due to the drought conditions, resulting in more acreage of bare ground, and a greater potential for the establishment of invasive, non-native plants, than should exist around well pads, roads, and pipelines.

Implementation of existing standards and guidelines do not seem to be adequate for protection of surface resources while allowing additional gas development.

Transportation

The road system, consisting mostly of single-use roads to service gas wells, is maintained primarily through agreements with the gas industry. The selection of the locations for new roads is presently dependent primarily on the location of proposed gas wells, without consideration of the effect new roads have on wildlife habitat, sediment delivery to the stream system, or cultural resources. New roads often do not have water control structures like culverts designed to handle the flows from the upstream watersheds, nor are many of them constructed according to standards and guidelines for ditches and gradients. The recent Roads Analysis Plan for the District (USFS 2003c) recommended that the main collector roads be upgraded to Maintenance Level 3 from Level 2 current designations. It also identified the high priority roads that contribute the most sedimentation to the stream system and recommended that these be examined in the field to plan for additional stabilization and improvement.

If the recommendations in the Roads Analysis Plan were implemented, the transportation system in the District would make progress toward meeting the goal of an environmentally acceptable road system. The goal in the Forest Plan that targets obliteration of roads is not likely to occur under existing guidelines and future projections for an increase in gas development without some new management decisions to manage the transportation system.

Livestock Grazing

The reference condition, or guidance in the Forest Plan, differs from the existing management of this program in the District. Forest Plan guidance calls for periodic forage production and utilization monitoring to determine appropriate livestock numbers and season of use in each allotment. If this guidance were carried out, permits for livestock grazing would correlate more closely with existing watershed condition than is currently the case. Managing livestock grazing according to the guidance in the Forest Plan by monitoring rangeland condition and setting stocking rates accordingly, would require a commitment of staff resources to carry out the effort, but would greatly help in achieving the goal of satisfactory watershed condition.

Recreation

The primary demand for recreation from the public for District land is for access to hunting. The District currently provides adequate facilities for seasonal hunters, mainly access roads and two campgrounds. While the campgrounds are primitive, they are adequate for the demand. Improving the collector roads would allow access by more types of vehicles because the roads would not be limited to high-clearance vehicles. This would improve access to the public, but most likely would have little effect on hunter access, other than providing more stable roads that would be less likely to be impassable during rainfall and thawing. The current plans and management appears to be adequate for the demand for recreation in the District.

Cultural Resources

The active management program for cultural resources has been instrumental in identifying and protecting cultural resources, especially archaeological sites. Field surveys to locate and record archaeological sites are conducted mainly in response to applications for permits to drill gas wells, to evaluate proposed well, road, or pipeline locations and their potential effects on cultural resources. If sites or areas of traditional cultural importance are found in the proposed construction areas, the location of proposed facilities may be moved to avoid the cultural resources. Other mitigation measures may also be agreed upon with the lessee before approval to drill is given. As a result, little systematic cultural resource surveys are conducted, due to limited staff resources.

Trends towards increasing surface disturbance due to gas development over the years have put more cultural resources in jeopardy from soil erosion, as well as from the alteration of the physical setting in which these resources are situated. The potential for damage to structures from vibrations due to heavy equipment and drilling operations has increased as gas wells fill in the open areas throughout the District. The increasing presence of roads in areas previously inaccessible to vehicular traffic has been shown to be accompanied by accelerated vandalism of archaeological sites situated near these new roads (Nickens et al. 1981), and may become a problem within the District. Access to the public by all-terrain vehicles, bicycles, and by hikers has increased even on gated roads. This easy access to much of the District may result in more damage to archaeological sites than would occur in areas without such a dense road network.

The identification of priority sites for nomination to the NRHP occurred during the process to designate Wild and Scenic Rivers areas, and some sites have been nominated in the past. Continuation of the implementation of ongoing programs, including compliance with the NHPA, NEPA, the Forest Plan, coordination with the State Historic Preservation Office (SHPO), and tribal consultation have helped to achieve the objectives of existing plans and to meet the reference conditions. Additional work is needed to develop a strategy for protection and stabilization of cultural resources damaged by the Bancos Canyon road and to ensure future protection of that important concentration of archaeological sites.